AEROFLEX

3900 Series
Digital Radio Test Set
DMR Option Manual

Issue-4

3900 Series

Digital Radio Test Set

DMR Option Manual

PUBLISHED BY
Aeroflex

Original Release	Aug 2009
Issue-2	Jun 2009
Issue-3	Dec 2009
Issue-4	Mar 2010

10200 West York/Wichita, Kansas 67215 U.S.A./(316) 522-4981/FAX (316) 524-2623

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Preface

Scope

This manual contains operational descriptions of the features contained in the 3900 Series DMR Test System Option. Refer to the 3900 Series Operation Manual for information regarding general Test Set operation.

Nomenclature Statement

The 3901, 3902 and 3920 Digital Radio Test Set is the official nomenclature for the test sets currently included in the 3900 Digital Radio Test Set Series. In this manual, 3900, unit or Test Set, refers to the 3901, 3902 and 3920 Digital Radio Test Sets unless otherwise indicated.

Intended Audience

This manual is intended for personnel familiar with the use of the 3900. Refer to the 3900 Series Operation Manual for information pertaining to Test Set operation.

Test Set Requirements

Refer to the 3900 Series Operation Manual for information on the following:

- Safety Precautions
- Power Requirements
- Platform Performance Data Specifications
- Repacking/Shipping Test Set

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Chapter 1

General Description

DMR Option Overview

The 3900 Digital Mobile Radio (DMR) Test System (390XOPT400) is an optional test system developed by Aeroflex to support the testing of digital two-way radio systems. DMR has been developed according to technical specifications outlined in ETSI TS 102 361-1, V1.4.1.

The 3900 DMR Test System Option provides the user with the following capabilities:

- Ability to lock/unlock paired generator and receiver frequencies;
- Ability to receive, demodulate and analyze DMR modulated signals;
- Ability to perform RF and modulation parametric tests on the Unit Under Test (UUT).
- Ability to select DMR or Analog Protocols;
- Distribution, Constellation and Eye Diagram graph plots;
- Variety of UUT measurements including Bit Error Rate, Signal Power, Slot Power, Frequency Error, Symbol Clock Error, Symbol Deviation and FSK Error;
- Power Profile Over Time, Profile Full and Profile Ramps Display Tiles;
- Spectrum Analyzer, Channel Analyzer and Oscilloscope available within the DMR Test System.

Installing DMR Option

Refer to the section titled Install New License (Option) File in Chapter 4 of the 3900 Series Operation Manual for option installation procedure.

DMR Option Status

Verifying DMR Option Installation

To check the status of installed options when operating in Test Mode:

1. Push the UTILS Key twice to access the Utils floating menu.
2. Select Software Settings, License from the floating menu.

The License Tile displays a list of installed options, including the version and version date of each option (refer to Fig. 1-1). DMR is 390XOPT400. The option list varies according to the features installed on the Test Set. "Try before you buy" options have an expiration date.

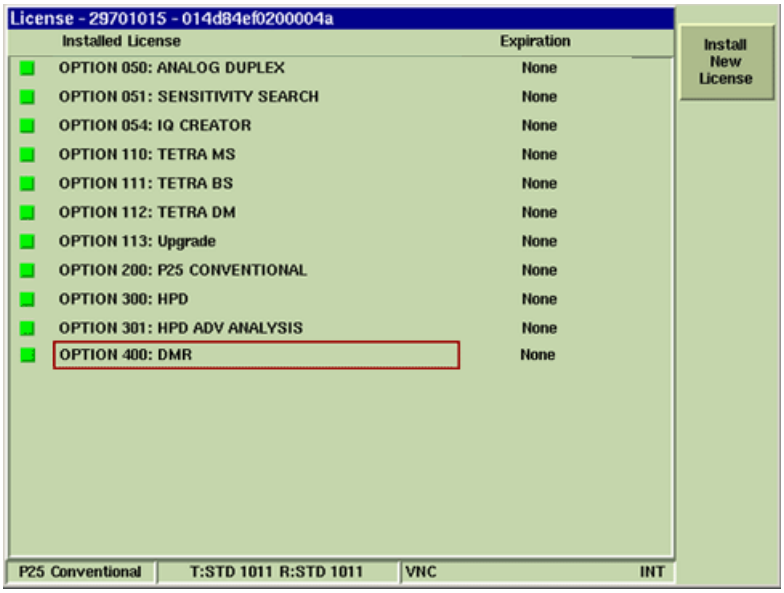

Fig. 1-1 3900 License Tile

Chapter 2

DMR System Operation

Introduction

This chapter describes DMR Tile layout and provides an operational description of DMR System Tile components.

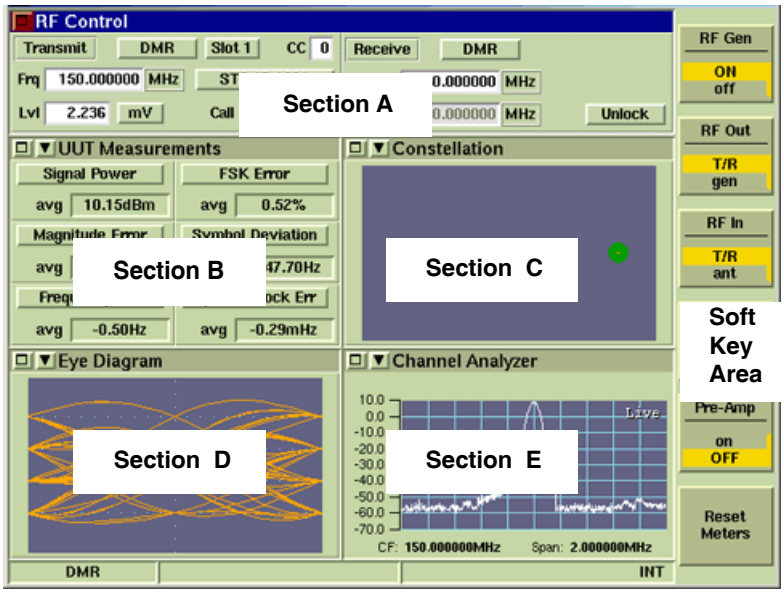

Fig. 2-1 DMR Display Layout

DMR System Tile Layout

The DMR Display Tiles can be configured according to test requirements. Each section of the display is configured using the drop-down menu on the title bar of each tile.

- Section A of the DMR User Screen always displays the RF Control Tile when the Tiles are minimized.
- DMR Test functions are selected from the drop-down menu located on the Tile menus on Sections B through E.
- DMR includes access to the Channel Analyzer, Spectrum Analyzer and Oscilloscope. Use of the Channel Analyzer, Spectrum Analyzer and Oscilloscope are described in the 3900 Series Operation Manual.

RF Control Tile

The RF Control Tile configures the Test Set for testing the physical layer of DMR radio systems. RF Control Tile fields must be configured according to the operating parameters of the Unit Under Test (UUT) to obtain valid test data.

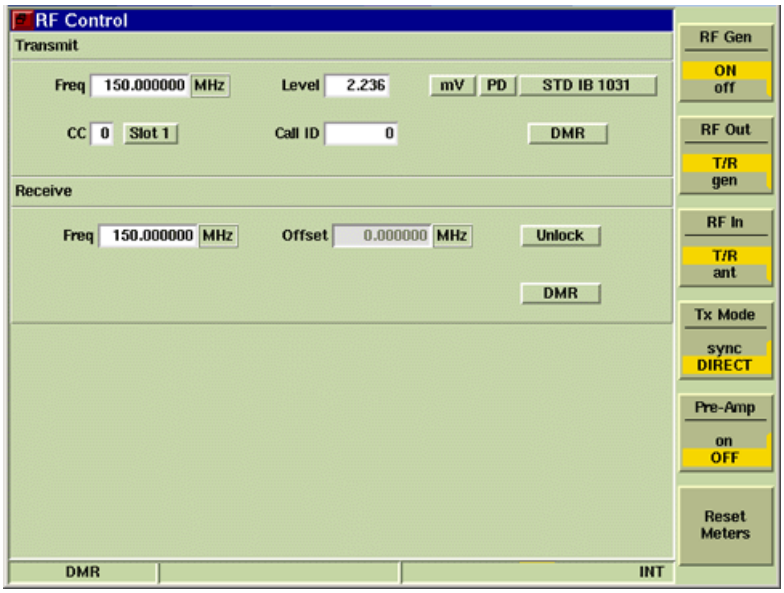

Fig. 2-2 DMR RF Control Tile

Transmit Field Definitions

Frq /Freq (Frequency)

The Transmit Frequency defines carrier frequency of the DMR signal being generated by the Test Set and is used to determine proper receiver operation. When used in conjunction with the Level, it is also used to determine UUT sensitivity by selecting the STD IB 1031 pattern.

Level

Level defines the output power of the 3900 DMR transmit signal from either the T/R or the GEN Connector. This is typically used to determine UUT receiver sensitivity using the STD IB 1031 pattern.

Units (Level)

The units drop-down menu selects the output power level unit of measure.

CC

The CC field defines the radio's Color Code.

Slot

The Slot drop-down menu selects either Slot 1 or Slot 2 for the transmit channel when the Tx Mode Soft Key is set to SYNC (Synchronized).

When the Tx Mode Soft Key is set to DIRECT, the Test Set transmits an unsynchronized signal which does not include the Slot parameter. The Slot drop-down menu changes to a display only field which displays the slot number last selected when in SYNC Mode.

Call ID

The Call ID field defines the radio's Call Identification value. This parameter is also referred to as the Destination ID or Group Address.

Protocol

Defines Protocol for Transmit Channel.

Pattern

The Pattern drop-down menu selects the type of pattern the Test Set sends to the UUT.

STD IB 511 (O.153)

The STD IB 511 Pattern is a test pattern that uses the O.153 standard pattern in the payload field of an Inbound burst. The STD IB 511 Pattern was implemented for future use.

STD IB CAL Pattern

The STD IB CAL Pattern is a test pattern that introduces errors into the STD IB 511 Pattern at specified bit locations (every 100th Bit) in order to generate a 1% Bit Error Rate (BER). This pattern is typically used to verify a radio's ability to calculate BER.

STD IB 1031 Pattern

When the STD IB 1031 is selected as the Transmit Pattern, the Test Set generates a signal that should produce a 1031 Hz tone in the radio. The STD IB 1031 Pattern contains a Color Code and Call ID parameter that must be defined according to the UUT in order to produce the 1031 Hz tone on the radio.

Every radio uses a Color Code to identify a specific radio system. A radio is programmed to ignore radio activity that does not contain the matching Color Code. The radio is also programmed to listen to one or more Call IDs plus the "All Call" ID (16777215).

To establish a call and obtain valid call data, the CC field must be set to the Color Code of the UUT. The Call ID must be set to one of the radio's programmed Call IDs or to the All Call ID (16777215).

STD OB TSYNC

The STD OB TSYNC pattern allows a radio programmed with a transmit offset to synchronize with an Outbound channel and transmit back on an offset channel. The CC Field defines the Color Code transmitted in the Slot PDU.

Receive Field Definitions

Frq /Freq (Frequency)

This field defines the receiver frequency. For accurate readings, this frequency should be set to the UUT transmit frequency.

Offset

When set to LOCK, changing the Receive or Transmit Frequency offsets the other frequency by the value specified in the Offset field. For example, setting the Receiver frequency to 150 MHz, with an offset of 2.5 MHz, results in the Transmit frequency updating to 152.5 MHz. Or, if the Transmit frequency is set to 150.0 MHz, with an Offset of 2.5 MHz, the Receive frequency updates to 147.5 MHz.

When set to UNLOCK, a value can be entered independently for either the Transmit Frequency or the Receiver Frequency.

Lock/Unlock

Locks/Unlocks frequency offset in relation to the Transmit and Receive frequencies.

Protocol

Defines Protocol for Receive Channel.

Soft Key Definitions

RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

RF Out Soft Key

Controls the RF Output signal routing. Select either the GEN (Generator) Connector or T/R Connector as RF Output port.

RF In Soft Key

The RF In Soft Key controls the RF Input signal routing. Select either the T/R Connector or ANT (Antenna) Connector as the RF Input port.

Tx Mode Soft Key

Selects DMR signal mode of operation. Direct Mode uses a free-running Inbound signal to evaluate mobile and base station performance.

Sync Mode synchronizes the timing of the Test Set's inbound signal with the outbound signal from a repeater. When Sync Mode is selected the Tx Slot drop-down menu is enabled which allows the user to select either Slot 1 or Slot 2 for the transmit channel.

Pre-Amp Soft Key

The 3900 is equipped with an internal 15 dB broadband amplifier that affects the T/R Connector and ANT (Antenna) Connector. When Pre-Amp is turned ON, the 3900 has a typical noise figure of -9 dB leading to a noise floor level of approximately -140 dBm in the Spectrum Analyzer (RBW = 300 Hz) and approximately -126 dBm for the Inband Power Meter (IF = 6.25 kHz). Using the Pre-Amp feature increases the sensitivity of the 3900.

NOTE

When Pre-Amp is used, special attention is required; it is a broadband amplifier and could lead to saturation or compression problems in the receiver chain if the signal of interest is very low, but a strong out of band signal is present.

Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

UUT Measurements Limits Configuration Tile

The UUT Measurement Configuration Tile allows the user to define limits for UUT Measurements meter readings.

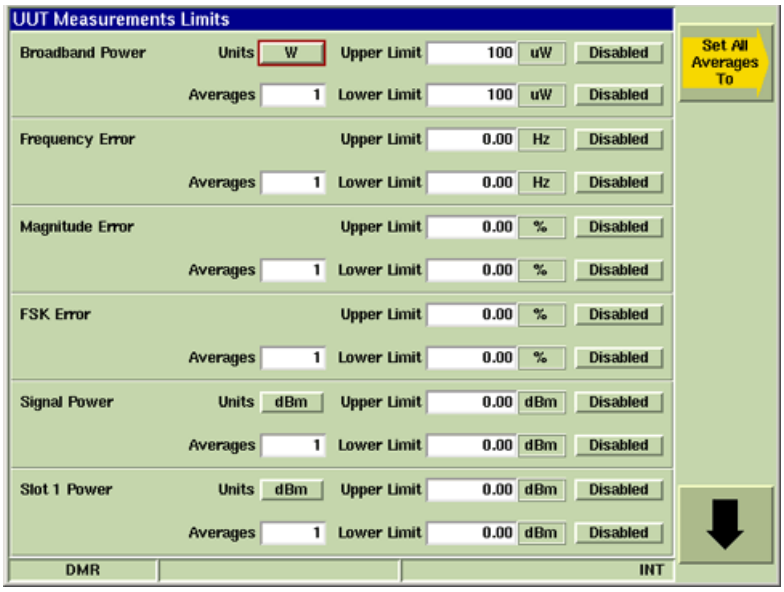

Fig. 2-3 UUT Measurements Limits Configuration Tile

Field/Soft Key Definitions

Disabled/Enabled

The Enable/Disable Toggle button turns defined limits on and off. Default values are applied if values are not defined by user.

Upper Limit

The UPPER LIMIT function sets a maximum acceptable reading for a specific measurement. When a measured level exceeds the enabled UPPER LIMIT, the Meter Bar and reading background on the Measurement Tiles turns RED.

When readings within enabled Upper and Lower limits the Meter Bar and reading background on the Measurement Tiles turns GREEN.

Lower Limit

When a measured level drops below the enabled LOWER LIMIT, the Meter Bar and reading background of the Measurement Tiles turns BLUE.

When readings within enabled Upper and Lower limits the Meter Bar and reading background on the Measurement Tiles turns GREEN.

Units

Selects the unit of measurement for applicable measurement.

Averages

Specifies the number of bursts over which data is averaged for each measurement. Values can be set independently for each meter. If the Averages field is set to 50, the Test Set averages data over 50 samples.

Set All Averages To Soft Key

Specifies the number of bursts over which data is averaged for all measurements. Values can also be set independently for each meter.

Audio Configuration Tile

The Audio Configuration Tile defines Audio modulator and AF generator parameters for use in testing Analog radio systems. Parameters can be defined separately for each modulator and AF generator. The Test Set is configured so that the user can simultaneously enable up to 3 modulators and 3 generators.

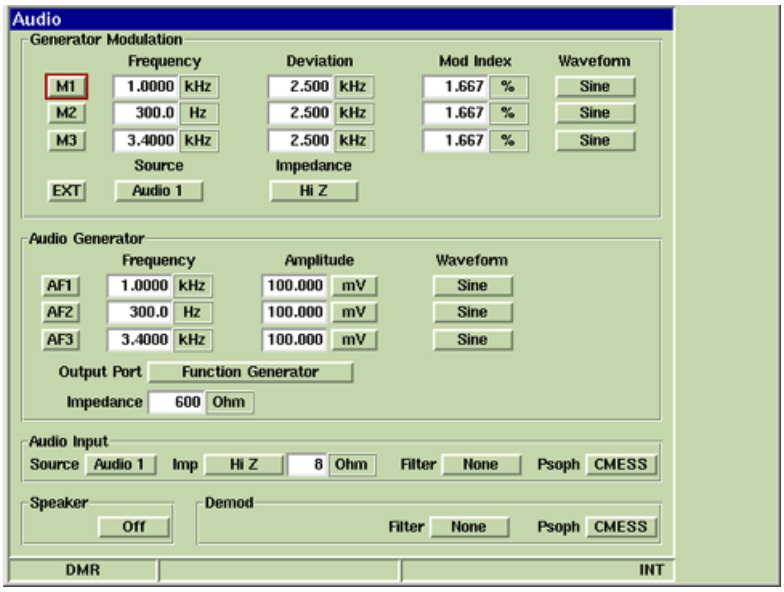

Fig. 2-4 DMR Audio Configuration Tile

Field Definitions

Modulation Generator Field Definitions

M1, M2, M3 Buttons

The Modulator buttons enable/disable each modulator. Modulators can be enabled in combination or individually.

Frequency

Sets the frequency for each Modulation generator.

Deviation

Defines the Deviation for each generator when FM modulation is selected. When this value is defined, the Modulation Index value updates to display the value as a percent.

Mod (Modulation) Index

The Mod Index field defines the modulation level as a percent of the maximum deviation setting (150 kHz). When a Mod Index value is entered, the Deviation value updates to display the value in kHz. For example, when the Mod Index value is set to 100%, the Deviation value updates to 150 kHz, the maximum Deviation setting.

Waveform

Selects Waveform for each modulator.

EXT Toggle Button

The EXT Toggle Button enables/disables an external modulation source.

Source

Selects the Audio input source.

Impedance

External source can be set to un-terminated high impedance (Hi Z), or include a 600 Ohm termination (600 Ohms).

AF Generator Field Definitions

Configures the Test Set's internal audio generator.

AF 1, 2, 3

The AF1, AF2 and AF3 toggle buttons enable/disable corresponding audio generator. AF Generators can be enabled in combination or individually.

Frequency

Sets the frequency for each AF generator. Frequency can be specified in kHz or Hz as defined by user.

Amplitude

Defines the amplitude for each AF Generator. Amplitude can be specified in V or mV as defined by user.

Waveform

Defines the Waveform for each AF Generator.

Output Port

Setting the Output Port to AF Out routes the output from the AF Generators to the FCTN GEN/ Demod Connector. Selecting Demod Out routes the demodulated audio signal to the FCTN/GEN Demod Out Connector.

Impedance

This field defines the external termination value used to calculate the AF Generator power level.

Audio Input

Parameters in this section configure the Test Set's Audio Input parameters.

Source

Selects the Audio input source.

Impedance

External source can be set to un-terminated high impedance (Hi Z), or include a 600 Ohm termination (600 Ohms).

External Load

External Load is used to calculate dBm or Watts when Hi Z Impedance is selected.

Filter

Selects a measurement filter to include in the measurement path.

Psoph

Selects CMESS or CCITT Psophometric weighting filter when the Psoph filter is selected from any of the Filter selection drop-down menus. Psoph filters are typically used for SINAD measurements, either Demod or Audio.

Speaker

Turns the Test Set's Loudspeaker On or Off.

Demod Input

Filter

Selects a measurement filter to include in the measurement path.

Psoph

Selects CMESS or CCITT Psophometric weighting filter when the Psoph filter is selected from any of the Filter selection drop-down menus. Psoph filters are typically used for SINAD measurements, either Demod or Audio.

Offsets Configuration Tile

The Offsets Configuration Tile allows users to define Generator (Tx) and Receiver (Rx) Level offsets.

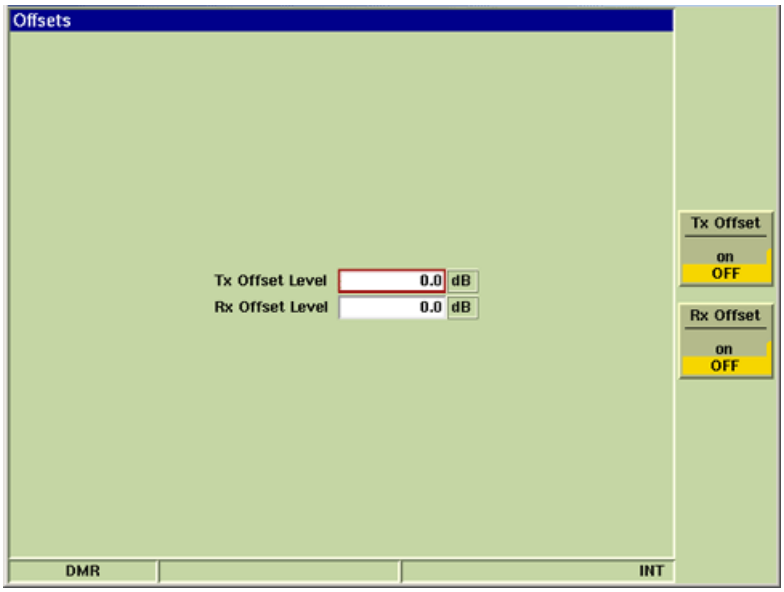

Fig. 2-5 Offsets Configuration Tile

Field/Soft Key Definition

Tx Offset Level

Defines RF Generator Level Offset value.

Rx Offset Level

Defines Receiver Level Offset value.

TX Offset/Rx Offset Soft Keys

Enables/Disables defined Tx and Rx offset values.

Decode Tile

The Decode Tile displays digital data contained in the signal received from the UUT. Color Code, Call ID and Unit ID do not apply to all types of received signals. Fields appear blank when data is invalid and display --- when they are not applicable to the received signal.

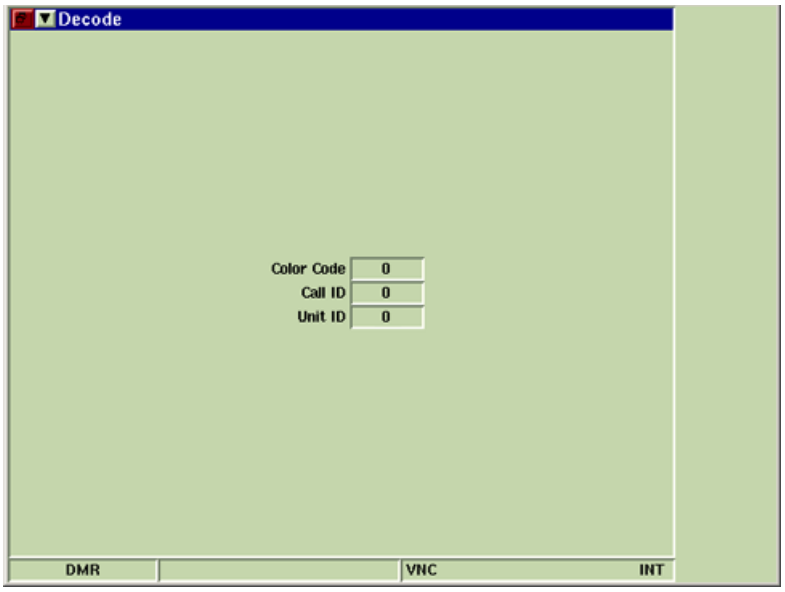

Fig. 2-6 Decode Tile

Field/Soft Key Definition

Color Code

Field displays the Color Code the Test Set receives from the UUT.

Call ID

Field displays the Call ID the Test Set receives from the UUT.

Unit ID

Field displays the Unit ID the Test Set receives from the UUT.

UUT Measurements Tile

The UUT Measurement Configuration Tile allows the user to define limits for UUT Measurements meter readings.

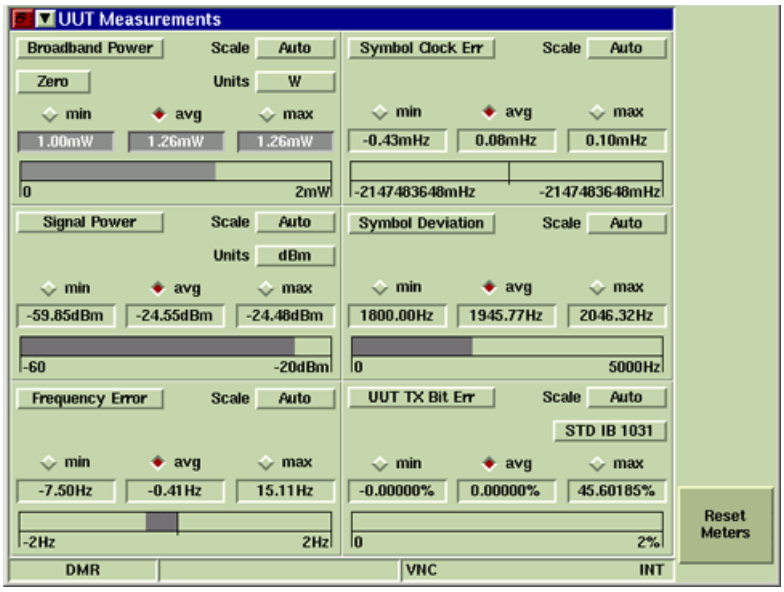

Fig. 2-7 UUT Measurements Tile

Field/Soft Key Definitions

min/avg/max Reading Indicators

These radio buttons select the reading displayed on the bar graphs and the reading displayed when the UUT Measurements Display Tile is minimized.

Selecting min displays the lowest recorded reading.

Selecting avg displays the average of all recorded readings over the period of defined bursts (default setting).

Selecting max displays the highest recorded reading.

Bar Graph

The METER BAR is a single, linear indicator that provides a visual measurement reading based on a user defined scale. Upper and lower limit indicators are set on the UUT Measurement Configuration Tile.

Refer to the section titled UUT Measurements Limits Configuration Tile for information on Upper and Lower Limits.

Scale

Defines the display of the METER BAR. User selection is made from a drop-down box offering the choice of Auto (default value) or a fixed value.

Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

Measurement Meters

The drop-down menu on each section of the UUT Measurements Tile selects the type of meter to be displayed in that section.

Broadband Power

The Broadband Power Meter measures input power levels at the T/R Connector over a range of 100 mW to 125 W. The Broadband Power Meter is frequency independent which allows the user to measure and align transmitter power settings without adjusting the 3900's receiver frequency to match the transmitter frequency.

Frequency Error

The Frequency Error Meter measures the frequency error of the incoming RF carrier signal. Frequency Error is calculated as the difference between the frequency of the received signal and the receive frequency defined on the RF Control Tile.

Magnitude Error

The Magnitude Error Meter indicates the Root Mean Square (RMS) of the difference between the expected and the received magnitude values. The Test Set measures Magnitude Error in two steps. First the expected magnitude is calculated as the mean of the received magnitudes. Then the Magnitude Error is computed by finding the RMS of the differences between the received magnitudes and the previously calculated expected magnitude.

FSK Error

The FSK Error Meter measures RMS deviation error at the symbol deviation points of the UUT signal. FSK Error is measured over one 30 ms slot and is expressed as the percentage of the deviation.

One slot of Outbound traffic (signal generated by BR) contains 144 symbols; inbound traffic (signal generated by mobile) contains 132 symbols. FSK Error should not exceed 5%.

The Advanced Analysis Tile provides more detailed FSK Error measurements.

Signal Power

The Signal Power Meter is a tuned power meter that indicates the amount of RF Energy that is contained within the 3900's selected receiver bandwidth (i.e., 12.5 kHz). The Signal Power Meter is tuned to a specific frequency, giving the ability to selectively measure the power of one channel when other channels are present.

Signal Power can be measured at the T/R or ANT Connector. The T/R Connector provides measurements from -60 to +51 dBm. The ANT Connector provides the ability to measure levels from -100 to +10 dBm.

Drop-down menu selects unit of measurement as dBm or Watts. When Watts is selected and the reading falls below 100 mW, the meter background turns GRAY, indicating the reading may be inaccurate. If this occurs, switch the unit of measurement to dBm to obtain an accurate reading.

Slot 1/Slot 2 Power

The Slot Power Meters indicate measurements for Slot 1 and Slot 2 of the DMR signal.

Symbol Clock Error

The Symbol Clock Error Meter measures the symbol clock of the received DMR signal over one 30 ms slot. Outbound traffic (signal generated by BR) contains 144 symbols; inbound traffic (signal generated by mobile) contains 132 symbols.

Symbol Clock Error measurements should not exceed ±48 mHz.

Symbol Deviation

The Symbol Deviation Meter measures the deviation of the DMR signal at symbol time, normalized to the 1944 Hz symbol point. Symbol Deviation is measured over one 30 ms slot.

Outbound traffic (signal generated by BR) contains 144 symbols; inbound traffic (signal generated by mobile) contains 132 symbols. Symbol deviation measurements should be >1750 and <2138.

UUT Tx Bit Error

The UUT Tx BER Meter compares incoming DMR symbol data to a standard pattern to determine errors in signal processing.

Audio/Demod Meters

The Audio and Demod meters are enabled when Analog protocol is selected on the Tx and Rx signals.

Audio/Demod Distortion Meters

The Audio Distortion Meter measures the amount of audio distortion a radio receiver may add to an audio signal during the demodulation process. The Demod Distortion Meter measures the amount of audio distortion created by a radio transmitter when an audio signal is modulated.

Audio Frequency Meter

The Audio Frequency Meter measures the frequency of the audio signal received at the Test Set's selected input connnector (i.e., Audio 1 or MIC Connector).

Demod Frequency Meter

The Demod Frequency Meter measures the frequency of the demodulated signal received at the Test Set's selected input connnector (i.e., Audio 1 or MIC Connector).

FM Deviation Meter

The FM Deviation Meter measures the amount of deviation present on an FM Modulated RF Signal received by the 3900. When Analog Protocol is selected, the FM Deviation Meter does not include a filter in the signal path.

Audio Level Meter

The Audio Level Meter measures the amplitude and audio signal received at the Test Set's selected input connnector (i.e., Audio 1 or MIC Connector).

Audio/Demod Sinad Meter

The AF Sinad Meter measures the receive quality of a radio receiver. The Modulation Sinad Meter measures the sinad of a transmitter.

Inband Power Meter

The Inband Power Meter indicates the total power measurement of the selected channel in the received RF Signal. Analog Protocol must be selected to enable this meter.

RF Error Meter

The RF Error Meter indicates the difference (frequency error) between the received RF signal and the defined receive frequency. RF Error measurements are only valid when Analog Protocol is selected. The accuracy of the RF Error Meter is defined by the Resolution drop-down menu.

Advanced Analysis Tile

The DMR Advanced Analysis Tile displays parametric readings and frequency data which allows the user to quickly evaluate radio signal quality. The FSK Error Meter on the UUT Measurements Tile provides a summary of the data found on the Advanced Analysis Tile.

The measurement meters on the left of the Advanced Analysis Tile display the same data as the meters on the UUT Measurements Tile. The Symbol Deviation data includes specified target values, actual values and percentage error values. Positive and negative symbol peak data corresponds to the positive and negative peaks on the Distribution Tile (Fig. 2-9). The Symbol Deviation data also includes Symbol Magnitude Error, Magnitude Peak and 4FSK Peak Error values.

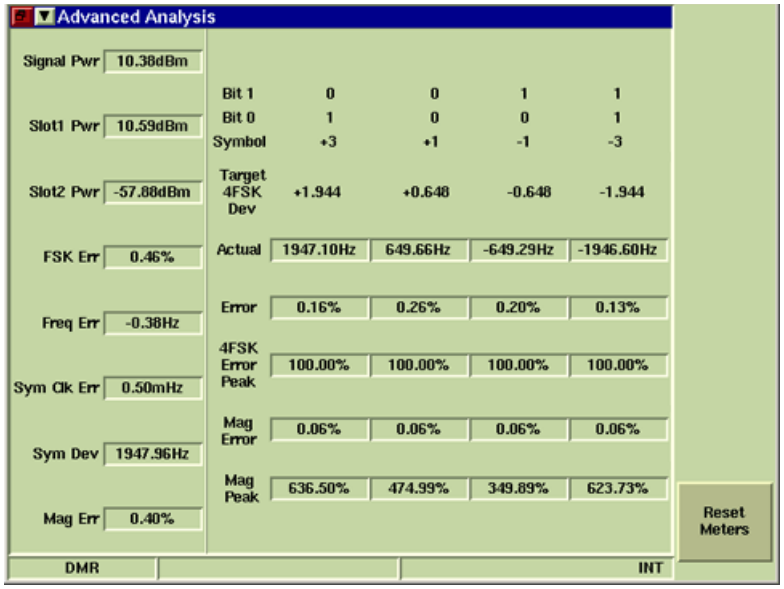

Fig. 2-8 Advanced Analysis Tile - Maximized View

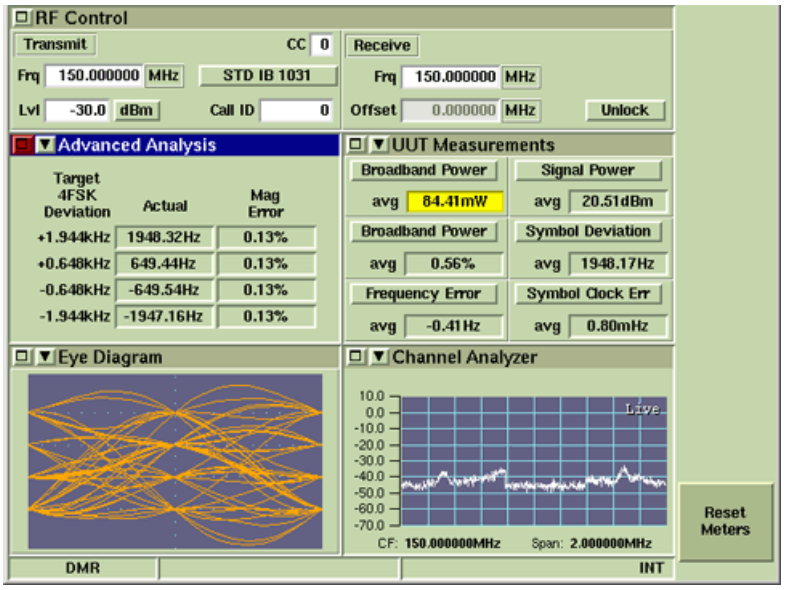

Fig. 2-9 Advanced Analysis and Distribution Tiles Selected

Constellation Tile

The Constellation tile is used to determine proper operation of the transmitter. The four points represent the four deviation states (DIBIT Symbols) of the DMR FSK modulation shown below. The green plot fields indicate the expected location of plot clusters.

Information Bits	Symbol	4FSK Deviation
01	+3	+1.944 kHz
00	+1	+0.648 kHz
10	-1	-0.648 kHz
11	-3	-1.944 kHz

DIBIT Symbol Mapping to 4FSK Deviation

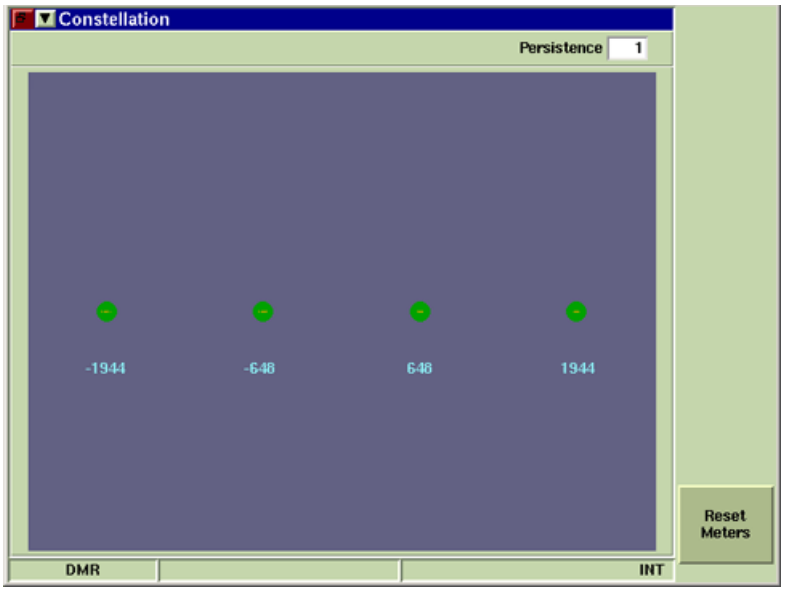

Fig. 2-10 Constellation Tile

Field/Soft Key Definitions

Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

Eye Diagram Tile

The Eye Diagram is used to plot the demodulated signal from one slot of the DMR signal. The plot shows the demodulated signal periods from that slot which allows the user to observe the deviation accuracy of the demodulated signal at the symbol points. The point at which symbol deviation is measured is referenced to the symbol clock to determine the deviation of the waveform at the symbol time.

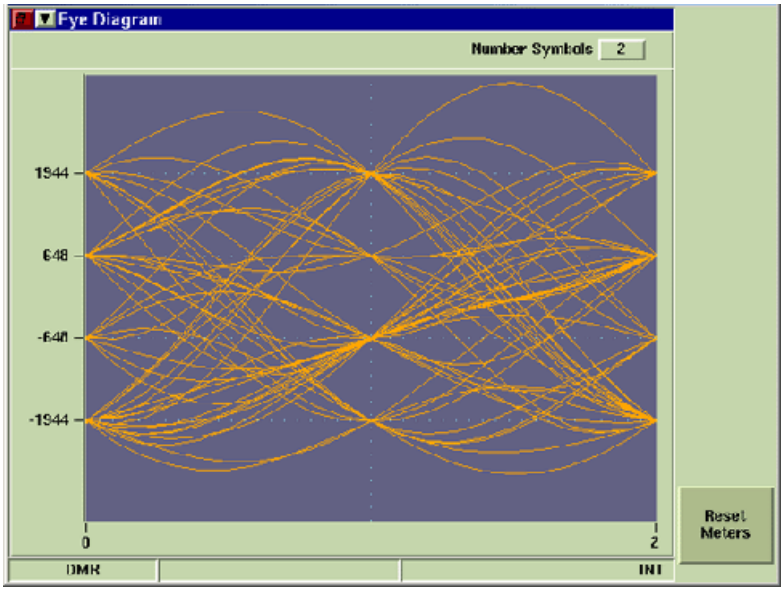

Fig. 2-11 Eye Diagram Tile - Maximized View - 2 Symbols

Field/Soft Key Definitions

Number Symbols

Defines the horizontal scale of the display field. Lowering the number or symbols shows more detail of the signal pattern.

Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

Distribution Tile

The Distribution Tile shows the relative number of symbols in relation to each other. The plot shows the four deviation points and the level of symbols accumulated over 38 slots. For example, a higher level on the +1 or 648 Hz deviation point would indicate that more “00” information bits were received compared to the other deviation points.

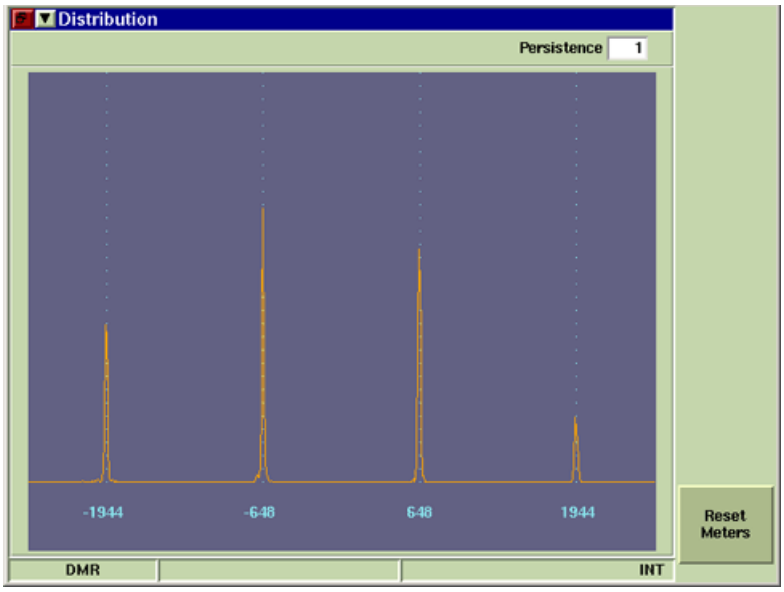

Fig. 2-12 Distribution Tile - Maximized View

Field/Soft Key Definitions

Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

Power Over Time Tile

The Power Over Time Tile displays the power measurement of the received signal over a specified period of time. This measurement provides an indication of the transmitter's stability.

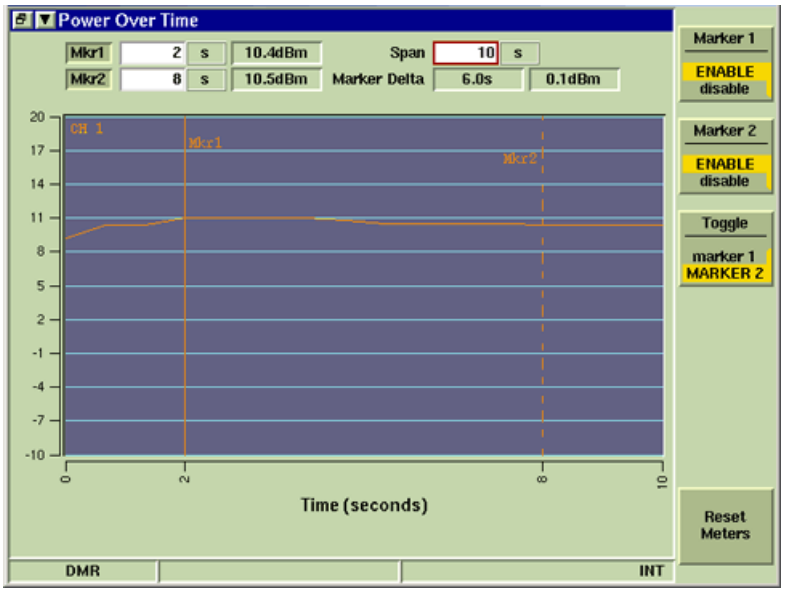

Fig. 2-13 Power Over Time Tile

Field/Soft Key Definitions

Mkr1/Mkr2

The Mkr1 and Mkr2 toggle buttons enable Marker 1 and Marker 2. Markers must be enabled to edit the Marker position fields. Status and functionality of these toggle buttons is linked to the Marker 1 and Marker 2 Soft Keys.

Marker Position

The Position Field allows the user to enter a value to specify Marker position on the graph field. A marker must be enabled and selected before this field can be edited.

Power Measurement

The data fields beside each marker position field indicate the power reading at the signal point.

Marker Delta

When both markers are defined and enabled the Delta field indicates the difference between the position and power measurement at each point on the signal.

Span

Span sets the length of time (horizontal scale) over which the power measurement is displayed. Maximum Span setting is 1800 seconds.

Marker 1/Marker 2 Soft Key

The Marker 1 and Marker 2 Soft Keys enables or disables the corresponding marker. Markers can also be enabled using the Marker On/Off toggle button.

Toggle Marker Soft Key

The Toggle Marker Soft Key changes focus between Marker 1 and Marker 2 when both markers are enabled. The Toggle Marker Soft Key also controls the marker readings displayed at the top of the minimized tile. Each press of this Soft Key changes the source of the measurements through Mkr1, Mkr2 and Delta readouts.

Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

Power Profile Full

The Power Profile Full Tile displays the complete profile of the signal's power reading over a period of time.

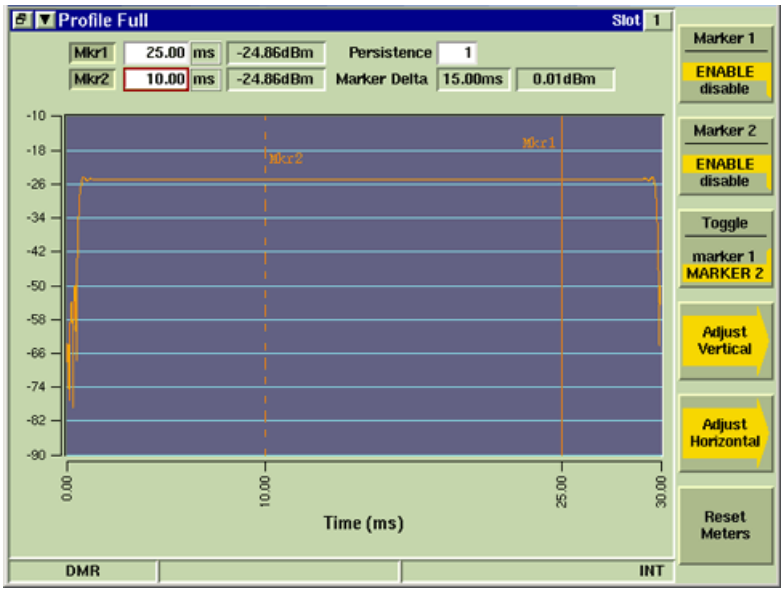

Fig. 2-14 Power Profile Full - Maximized View

Field/Soft Key Definitions

Mkr1/Mkr2

The Mkr1 and Mkr2 toggle buttons enable Marker 1 and Marker 2. Markers must be enabled to edit the Marker position fields. Status and functionality of these toggle buttons is linked to the Marker 1 and Marker 2 Soft Keys.

Horizontal Position

The Position Field allows the user to enter a value to specify Marker position on the graph field. A marker must be enabled and selected before this field can be edited.

Power Reading

The field to the right of the Horizontal Position field indicates the Power reading at the marker's position.

Marker Delta

When both markers are defined and enabled the Delta field indicates the difference between the position and power measurement at each point on the signal.

Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

Slot

The Slot drop-down menu selects the Slot (0 or 1) for which data is being displayed on the plot and measurement fields.

Marker 1/Marker 2 Soft Key

The Marker 1 and Marker 2 Soft Keys enables or disables the corresponding marker. Markers can also be enabled using the Marker On/Off toggle button.

Toggle Marker Soft Key

The Toggle Marker Soft Key changes focus between Marker 1 and Marker 2 when both markers are enabled. The Toggle Marker Soft Key also controls the marker readings displayed at the top of the minimized tile. Each press of this Soft Key changes the source of the measurements through Mkr1, Mkr2 and Delta readouts.

Adjust Vertical Soft Key

The Adjust Vertical soft key opens a soft key sub-menu. The sub-menu soft keys adjust the position of the Vertical Scale and appearance of the signal on the graph. Scale is adjusted in increments of 10 dBm.

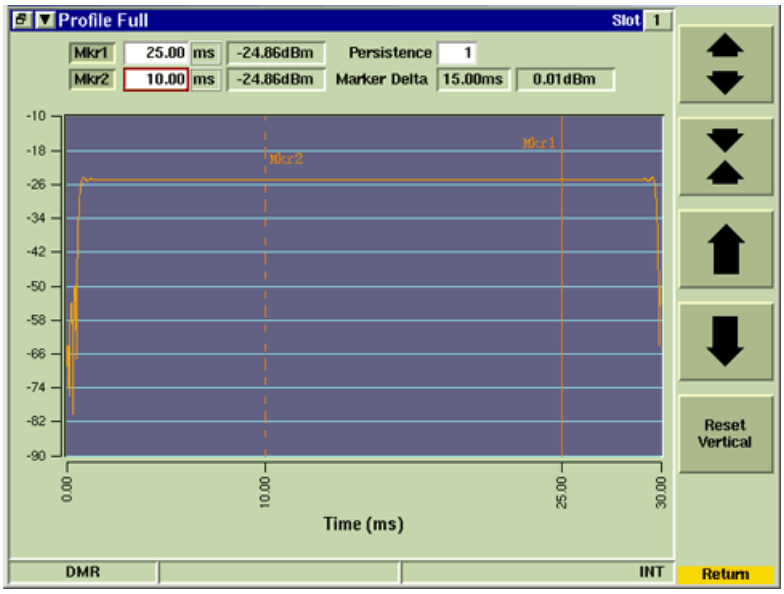

Fig. 2-15 Power Profile Full - Adjust Vertical Soft Key Sub-menu

Reset Vertical Soft Key

Resets all vertical values to default values and centers trace pattern vertically on the graph field. This soft key is accessed by pressing the Adjust Vertical Soft Key.

Adjust Horizontal Soft Key

Adjust Horizontal soft key opens a soft key sub-menu that allows users to adjust the position and range of the graph's horizontal scale. This feature can be used to focus on specific time spans of the slot, such as the first 2 ms (msec) or the last 5 ms (msec).

The largest range setting for Outbound and Inbound Reserved signal is 0 to 30 ms. The largest range setting for Inbound Random signals is 0 to 10 ms. The smallest range setting is 2 ms.

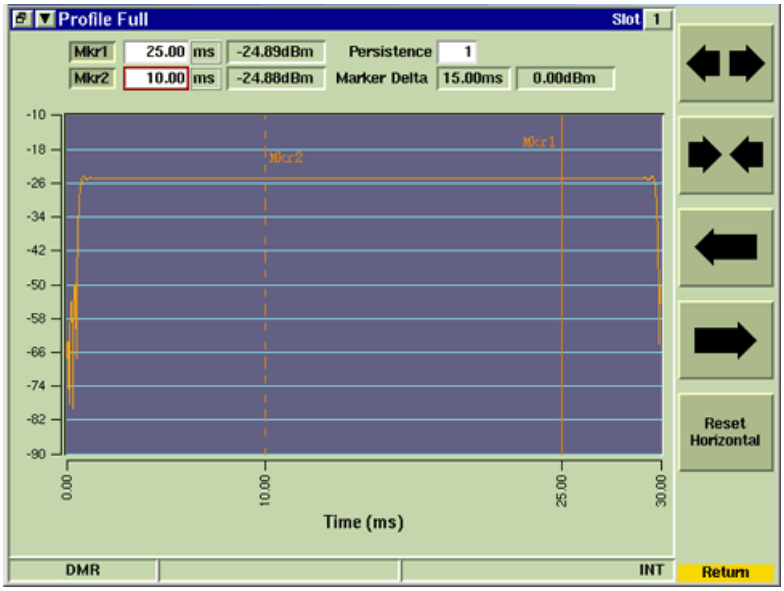

Fig. 2-16 Power Profile Full Adjust Horizontal Soft Key Sub-menu

Reset Horizontal Soft Key

Resets the horizontal scale to default settings. This soft key is accessed by pressing the Adjust Horizontal Soft Key.

Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

Power Profile Ramps

The Profile Ramps Tile displays the ramp profile of the signal's power reading over one slot. The left side of the field provides a detailed view of the first 2 ms (msec) of the slot. The right side of the field provides a detailed view of the last 2 ms (msec) of the slot.

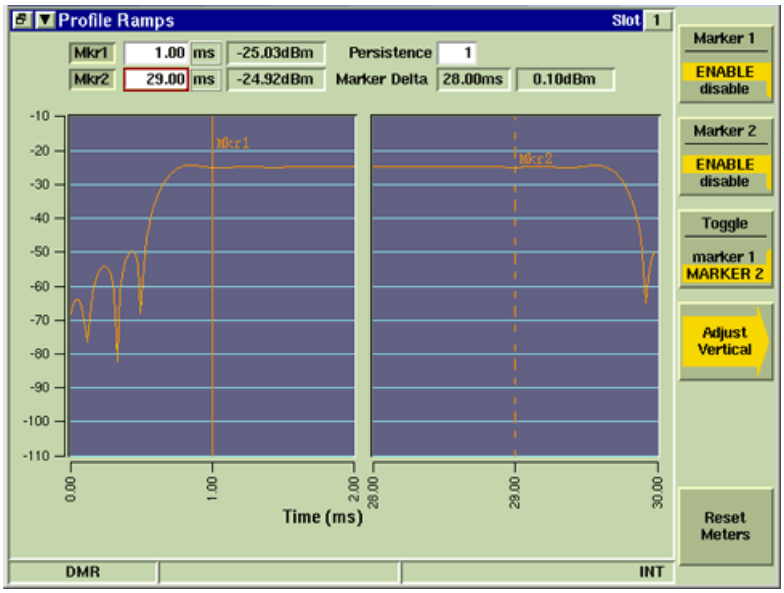

Fig. 2-17 Power Profile Ramps

Field/Soft Key Definitions

Mkr1/Mkr2

The Mkr1 and Mkr2 toggle buttons enable Marker 1 and Marker 2. Markers must be enabled to edit the Marker position fields. Status and functionality of these toggle buttons is linked to the Marker 1 and Marker 2 Soft Keys.

Horizontal Position

The Position Field allows the user to enter a value to specify Marker position on the graph field. A marker must be enabled and selected before this field can be edited.

Power Reading

The field to the right of the Horizontal Position field indicates the Power reading at the marker's position.

Marker Delta

When both markers are defined and enabled the Delta field indicates the difference between the position and power measurement at each point on the signal.

Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

Slot

The Slot drop-down menu selects the Slot (0 or 1) for which data is being displayed on the plot and measurement fields.

Marker 1/Marker 2 Soft Key

The Marker 1 and Marker 2 Soft Keys enables or disables the corresponding marker. Markers can also be enabled using the Marker On/Off toggle button.

Toggle Marker Soft Key

The Toggle Marker Soft Key changes focus between Marker 1 and Marker 2 when both markers are enabled. The Toggle Marker Soft Key also controls the marker readings displayed at the top of the minimized tile. Each press of this Soft Key changes the source of the measurements through Mkr1, Mkr2 and Delta readouts.

Adjust Vertical Soft Key

The Adjust Vertical soft key opens a soft key sub-menu. The sub-menu soft keys adjust the position of the Vertical Scale and appearance of the signal on the graph. Scale is adjusted in increments of 10 dBm.

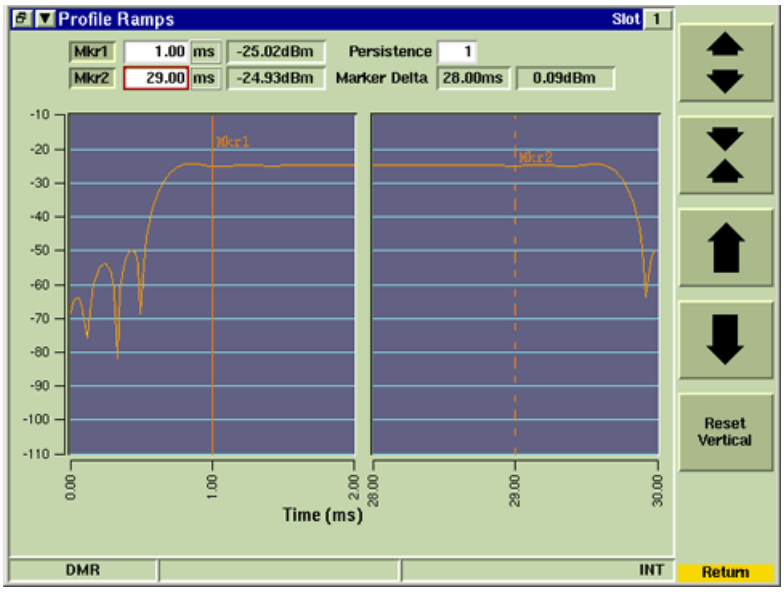

Fig. 2-18 Power Profile Ramps - Adjust Vertical Soft Keys Sub-menu

Reset Vertical Soft Key

Resets all vertical values to default values and centers trace pattern vertically on the graph field. This soft key is accessed by pressing the Adjust Vertical Soft Key.

Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

Chapter 3

DMR Channel Logger

Introduction

The DMR Channel Logger (390XOPT402) allows XML formatted information, referred to in this manual as XML files, to be relayed to and from a remote PC location and a Test Set. Each XML file contains processing instructions, a timestamp, and MAC header and MAC data blocks. When the PC and Test Set are connected, the Test Set sends any valid received DMR data to the PC in XML format. The PC receives the XML file, which can be saved to a file, edited and re-transmitted to the Test Set, or deleted.

NOTE

Received XML files can be viewed by either a text editor or a customer developed Viewing Application. This is an **option enabled* feature.

Viewing Application

The following information is necessary to develop an internal viewing application:

- The Test Set Raw Data Service is 'listening' on TCP socket number 2222.
- The Test Set's IP address can be configured and accessed from the Network Utility Tile. Refer to the 3900 Series Operation Manual for use of this feature.
- Netcat application for transferring XML commands to and from the Test Set. Netcat is available at http://www.vulnwatch.org/netcat/.

Connecting Equipment

To use the User Data I/O Port, the PC and the Test Set must be operating on the same local network via an Ethernet cable. Once equipment is connected, XML files can be transmitted to and from the PC and the Test Set. In this configuration, the Test Set functions as a TCP socket "server" and the users PC application functions as a TCP "client." The port number used by the Test Set is 2222.

NOTE

The TCP socket on the PC should be opened in "blocking" mode so that XML data is not lost when it is sent to the Test Set. PC processing speed must be sufficient to allow it to accept the incoming data burst stream of XML lines.

DMR XML Command Structure

This section describes DMR XML commands and command formatting instructions. This section is intended for users familiar with XML and therefore only describes XML commands specific to the DMR Data I/O Port feature.

The DMR RF Control Tile must be configured with the same settings defined in the XML command script prior to sending or receiving XML data.

<burst></burst>

The <burst> tag has the following attributes:

timestamp

The timestamp command is an 8 digit hexadecimal number representing:

- On data sent to the Test Set: the time of transmission of the data in the burst.
- On data received from the Test Set: the time of reception of the burst.

The timestamp is optional on commands sent to the Test Set. It is present on data loads received from the Test Set

Times are all referenced from the first bit of the burst. They are relative to an arbitrary value, so timestamps should only be used is to compute the times between bursts in the same capture.

Timestamp resolution is 20 nsec, meaning a burst at 00000010 and a burst at 00000020 are 320 nsec apart (20 HEX - 10 HEX is 16 decimal, x 20 ns timestamp resolution is 320 nsec).

phys_channel

This command specifies the channel (0 or 1) being transmitted or received.

0 = Channel 1

1 = Channel 2

direction

This command specifies whether the signal is being transmitted (tx) or received (rx).

detect

The field is used with receive only signals. Command indicates if received signal is valid or invalid.

type

Indicates if data is an inbound service packet (isp) or outbound service packet (osp).

timeslot

Indicates which timeslots in a TDMA system a specific data element is sent or received.

The command is skipped when it is received in a non-TDMA mode system or when command is not applicable to command usage.

Filter Parameters

<LogFilter></LogFilter>

The user may specify what types of information are to be sent from the Test Set by using the <LogFilter> tag. This tag requires using the parameter "phys_channel", which has the same meaning as the "phys_channel" of the <burst> tag.

The <LogFilter> tag requires using the following sub-tags (all sub-tags MUST be present), each of which is a boolean value (0/1 on/off true/false):

<Environment></Environment>

The Environment tag controls the logging of Test Set configuration changes, such as received frequency, transmit frequency, etc.

<Raw></Raw>

Raw controls the logging of raw octets received.

<Protocol_Raw></Protocol_Raw>

Protocol_Raw controls the logging of raw protocol data (after decoding from the raw data stream but without interpretation).

<Protocol_Cooked></Protocol_Cooked>

Protocol_Cooked controls the logging of protocol data with the data parsed into a more legible format.

<Voice></Voice>

Voice controls logging of the voice data as sent to the vocoder.

Example LogFilter:

```
<LogFilter phys_channel="1">
  <Environment>0</Environment>
  <Raw>0</Raw>
  <Protocol_Raw>0</Protocol_Raw>
  <Protocol_Cooked>0</Protocol_Cooked>
  <Voice>0</Voice>
</LogFilter>
```

NOTE

The following example DOES NOT WORK: it is missing some of the required subtags:

```
<LogFilter phys_channel="1">
  <Environment>0</Environment>
  <Raw>0</Raw>
</LogFilter>
```

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Appendix A

DMR Terms and Abbreviations

avg	Average reading
Bit Err	Bit Error Rate
CONFIG	Configuration
dB	decibel
dBm	decibel relative to 1 mW
dBV	decibel relative to 1 Volt
dBW	decibel relative to 1 Watt
DMR	Digital Mobile Radio
frq/freq	Frequency
FSK	Frequency Shift Keying
GEN	Generate/Generator
GHz	Giga Hertz
Hz	Hertz
kHz	kilo Hertz
Lvl	Level
max	Maximum reading
MHz	Mega Hertz
min	Minimum reading
Mkr	Marker
Mod	Modulation
ms/msec	Millisecond
mW	milli-Watt
RF	Radio Frequency
Rx	Receive
TOS	Top of Scale
Tx	Transmit
UTILS	Utilities
UUT	Unit Under Test
VNC	Virtual Network Client/Virtual Network Computing
W	Watt

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CHINA / Beijing	Tel: [+86] (10) 6539 1166	Fax: [+86] (10) 6539 1778
CHINA / Shanghai	Tel: [+86] (21) 5109 5128	Fax: [+86] (21) 6457 7668
FINLAND	Tel: [+358] (9) 2709 5541	Fax: [+358] (9) 804 2441
FRANCE	Tel: [+33] 1 60 79 96 00	Fax: [+33] 1 60 77 69 22
GERMANY	Tel: [+49] 8131 2926-0	Fax: [+49] 8131 2926-130
HONG KONG	Tel: [+852] 2832 7988	Fax: [+852] 2834 5364
INDIA	Tel: [+91] (0) 80 4115 4501	Fax: [+91] (0) 80 4115 4502
JAPAN	Tel: [+81] 3 3500 5591	Fax: [+81] 3 3500 5592
KOREA	Tel: [+82] (2) 3424 2719	Fax: [+82] (2) 3424 8620
SCANDINAVIA	Tel: [+45] 9614 0045	Fax: [+45] 9614 0047
***SINGAPORE**	Tel: [+65] 6873 0991	Fax: [+65] 6873 0992
SPAIN	Tel: [+34] (91) 640 11 34	Fax: [+34] (91) 640 06 40
UK / Cambridge	Tel: [+44] (0) 1763 262277	Fax: [+44] (0) 1763 285353
***UK / Stevenage**	Tel: [+44] (0) 1438 742200 Freephone: 0800 282388	Fax: [+44] (0) 1438 727601
***USA**	Tel: [+1] (316) 522 4981 Toll Free: 800 835 2352	Fax: [+1] (316) 522 1360

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